Graviton-graviton scattering near a weakly coupled string description

Thomas Evans

Author Contact: Thomas Evans
Telephone: (908)-213-3127
Cellphone: (908)-763-5890
Email: Tevans@belvideresd.org
Affiliated institution: Belvidere High School, Belvidere Township, NJ
Affiliated institution contact: (908)-454-6600

Graviton-graviton scattering near a weakly coupled string description Thomas Evans

Abstract: We consider graviton-graviton scattering with center-of-mass energy E, supposing nearness to a weakly coupled string description, at some small but finite coupling g. We utilize a ten-dimensional gravitational constant of order $G_N \sim g^2\alpha'^4$. We demonstrate the evolution of a pure state into density matrices, which may be more effectively represented by a model proposed herein, as well as a concept of staticity matrices. It is asserted that these staticity matrices have a corresponding density mode, given by its elements as density matrices. It is then shown that these modes can thus be characterized only by the theoretical introduction of a constant, which we shall denote EGM, which is an acronym for equigravimagnetism. We introduce an interesting relationship between this constant and Einstein's cosmological constant Λ. Consequential of supersymmetry, we may contain the properties of the entire Fock space of massless well separated particles of the supergravity theory. We introduce a space characterized mathematically by density modes, that may be interpreted equivalently as nonsingular projective algebraic varieties in a holomorphic-commutative geometry embedded in a holomorphic-commutative spacetime. This holomorphic-commutative spacetime is effectively nullified by the supersymmetry of our modeling, proposed within. We thus may completely characterize an attempted reconciliation of quantum field theory/cosmology, general relativity, and the various string theories, in terms of density modes. Mathematically, we use the geometries of Riemann, Christoffel, and the general extensions there from, cohomology, k-theory, matrix theory, and topology. Familiarity with the work of Hodge and, overall, algebraic geometry, is assumed.

Introduction: It is the purpose of this paper to, generally, demonstrate a tentative reconciliation of some concepts within the various theories of quantum field theory/cosmology, general relativity, and the differing string theories. This is attempted through the theoretical introduction of a constant, EGM, denoted λ. There are a number of interesting relationships which we observe after the introduction is carried out, one of these is too lengthy to investigate within the context of this paper however it will be presented within a work of later date. Namely, given the value of this constant EGM, λ, we may effectively calculate large areas of $-\Lambda$, which correspond significantly to areas of observable "dark matter" within the universe. Although there are a number of other phenomena derivative of this constant λ, we limit details to the above. Mathematically we also obtain some results of presumable interest, namely the concepts of density/staticity matrices and corresponding density modes. From an analysis of these concepts given parameterizations of a modeling described within, we find the concept of dimension to be unnecessary at best, and a misinterpretation at worst. We now begin with an summary of the background material used: A graviton of momentum $p_{10} = n / R_{10}$ is a bound state of n D0-branes. Given a bound state of total momentum q_i, the SU(n) dynamics is responsible for the zero-energy bound state, and the center-of-mass energy E from the U(1) part $p_i = q_i I_n / n$ is

$$E = \frac{R_{10}}{2}\mathrm{Tr}(p_i p_i) = \frac{q^2}{2p_{10}},$$

which correctly reproduces the energy of a particle with n units of compact momentum,

$$E = (p^2{}_{10} + q^2 + m^2) \approx p_{10} + \frac{q^2 + m^2}{2p_{10}} = \frac{n}{R_{10}} + \frac{R_{10}}{2n}(q^2 + m^2).$$

We consider both a simple interaction, graviton-graviton scattering, and a graviton-graviton scattering given to one-loop order. Let the gravitons have 10-momenta $p_{10} = n_{1,2} / R_{10}$ and be at well-separated positions $Y^i_{1,2}$. The total number of D0-branes is $n_1 + n_2$, and the coordinate matrices X^i are approximately block diagonal. Write X^i as

$$X^i = X^i{}_0 + x^i$$

$$X^i_0 = Y^i_1 I_1 + Y^i_2 I_2, \qquad x^i = x^i{}_{11} + x^i{}_{22} + x^i{}_{12} + x^i_{21}.$$

Here I_1 and I_2 are the identity matrices in the two blocks, which are respectively $n_1 \times n_1$ and $n_2 \times n_2$, and we have separated the fluctuation x^i into a piece in each block plus off-diagonal pieces. First setting the off-diagonal $x^i_{12,21}$ to zero, the blocks decouple because $[x^i_{11}, x^j_{22}] = 0$. The wavefunction is then a product of the corresponding bound state wavefunctions,

$$\psi(x_{11}, x_{22}) = \psi_0(x_{11})\psi_0(x_{22}).$$

We now consider the off-diagonal block. These degrees of freedom are heavy: the commutator

$$[X^i_0, x^j_{12}] = (Y^i_1 - Y^i_2)x^j_{12}$$

gives them a mass proportional to the separation of the gravitons. Thus we can integrate them out to obtain the effective interaction between the gravitons (Polchinski, 1998). This may be utilized to see that the effective interaction at long distance agrees with eleven-dimensional supergravity. This may be obtained through the cylinder amplitude [1], as follows. At distances small compared to the string scale, the cylinder is dominated by the lightest open strings stretched between the D0-branes, which are precisely the off-diagonal matrix theory degrees of freedom. At distances long compared to the string scale, the cylinder is dominated by the lightest closed string states and so goes over to the supergravity result. This is ten-dimensional supergravity, but it is equivalent to the answer from eleven-dimensional supergravity, as in the process we are observing, the sizes of the blocks stay fixed at n_1 and n_2, meaning that the values of p_{10} and p'_{10} do not change in the scattering and the p_{10} of the exchanged graviton is zero. This has the effect of averaging over x^{10} and so giving the dimensionally reduced answer. Finally, we should keep only the leading velocity dependence from the cylinder, because the time dilation from the boost suppresses higher power our initial value of the energy. The result for $p = 0$, multiplying by the number of D0-branes in each clump, is

$$L_{\text{eff}} = -V(r,v) = 4\pi^{5/2}\Gamma(7/2)\alpha'^3 n_1 n_2 \frac{v^4}{r^7}$$

$$= \frac{15\pi^3}{2} \frac{p_{10}p'_{10}}{M_{11}^9 R_{10}} \frac{v^4}{r^7}.$$

Because the functional form is the same at large and small r, the matrix theory correctly reproduces the supergravity amplitude (Polchinski, 1998). It is apparent that we must take the large n limit to obtain agreement with supergravity. The loop expansion parameter in the quantum mechanics is then large, so perturbative calculations are not sufficient. Also, the process being studied here, where the p_{10} of the exchanged graviton vanishes, is quite special. When this is not the case, one has a very different process where the sizes of the blocks change, meaning that D0-branes move from one clump to the other. We assert that this phenomena may be attributed to our following analysis of the characterizations of a string theory-modeling given density modes, so that our characterization of the said modes allows for this case given our constant λ present. This is a phenomena of interest, and we find, in a later section, that we may characterize the majority, if not all, of our physically observable results given the presence of the constant λ. In later work we extend this, and we may equate our aforementioned modeling to the curl of a vector defined for our density, and some yet to be introduced, modes. We will also observe, again in a subsequent paper, that we may verify our and the general results of matrix theory by our calculation of the presence of "dark matter" relative to our constant EGM, i.e. by the relation $\lambda \cong -\Lambda$. Thus, we can verify calculations of graviton-graviton scattering numerically at any energy. In order to correspond with the said modeling, we will see that for any simulation at finite n and R_{10}, we must nullify n, and modify R_{10} corresponding to the given density matrices and, later, modes.

For a summary of graviton-graviton scattering to one-loop order, the author refers the reader to [2].

1) The M-theory membrane, matrix-theory membranes, and our proposed modeling

In this section, we present a summary of results concerning the M-theory membrane, and then our proposed modeling with a corresponding analysis.

If the matrices X^i are a complete set of degrees of freedom, then it must be possible to identify all the known states of M-theory, of interest to our work, the membranes. It has been presented that the membranes are already present as excitations of the D0-brane Hamiltonian, simplifying the necessary work, as one would otherwise have to add the explicit d2-brane degrees of freedom. To see this, we define the $n \times n$ matrices

$$U = \begin{bmatrix} 1 & 0 & 0 & 0 & \\ 0 & \alpha & 0 & 0 & \cdots \\ 0 & 0 & \alpha^2 & 0 & \\ 0 & 0 & 0 & \alpha^3 & \\ & \vdots & & & \ddots \end{bmatrix}, \qquad V = \begin{bmatrix} 0 & 0 & 0 & & 1 \\ 1 & 0 & 0 & \cdots & 0 \\ 0 & 1 & 0 & & 0 \\ 0 & 0 & 1 & & 0 \\ & \vdots & & \ddots & \end{bmatrix},$$

where $\alpha = \exp(2\pi i / n)$. These have the properties

$$U^n = V^n = 1, \quad UV = \alpha VU,$$

and these properties determine U and V up to change of basis. The matrices $U^r V^s$ for $1 \le r, s \le n$ form a complete set, and so any matrix can be expanded in terms of them. Thus,

(1.1) $$X^i = \sum_{r,s=[1-n/2]}^{[n/2]} X^i_{rs} U^r V^s,$$

with [ ] denoting the integer part and similarly for the fermion λ. To each matrix we can then associate a periodic function of two variables,

(1.2) $$X^i \to X^i(p,q) = \sum_{r,s=[1-n/2]}^{[n/2]} X^i_{rs} \exp(ipr + iqs).$$

Focusing on matrices which remain smooth functions of p and q as n becomes large (so that the typical r and s remains finite), the commutator maps

(1.3) $$\begin{aligned}[X^i, X^j] &\to \frac{2\pi i}{n}(\partial_q X^i \partial_p X^j - \partial_p X^i \partial_q X^j) + O(n^{-2}) \\ &\equiv \frac{2\pi i}{n}\{X^i, X^j\}_{PB} + O(n^{-2}).\end{aligned}$$

We can verify this by considering simple monomials $U^r V^s$. Notice the analogy to taking the classical limit of a quantum system, with the Poisson bracket appearing. We have the Hamiltonian

(1.4)
$$R_{10} \int dq dp \left(\frac{n}{8\pi^2} \Pi_i \Pi_i + \frac{M_{11}^6}{16\pi^2 n} \{X^i, X^j\}_{PB}^2 - i \frac{M_{11}^3}{8\pi^2} \lambda \Gamma^0 \Gamma^i \{X^i, \lambda\}_{PB} \right).$$

Since $X^i(p,q)$ is a function of two variables, this Hamiltonian describes the quantum mechanics of a membrane. It is identical to the Hamiltonian one gets from an eleven-dimensional supersymmetric membrane action in the light-cone gauge (Polchinski, 1998). We obtain the static configuration and the energy,

(1.5) $$X^1 = aq, \qquad X^2 = bq;$$

(1.6) $$\frac{M_{11}^6 R_{10} a^2 b^2}{2n} = \frac{M_{11}^6}{2(2\pi)^4 p_{10}} = \frac{\tau_{M2}^2 A^2}{2 p_{10}},$$

where $A = 4\pi^2 ab$ is the area of the membrane. The product $\tau_{M2} A$ is the mass of an M-theory membrane of this area, so this agrees with the energy.

A variety of circumstances as listed in [3] lead us to the following conclusions regarding matrix-theory membranes, i.e. D0-branes: First, that M-theory in the infinite momentum frame is a theory in which the only dynamical degrees of freedom (partons) are D0-branes. Secondly, all systems are built out of composites of partons, each of which carries the minimal p_{11}. For a summary of D0-brane mechanics in an infinite momentum frame, we refer the reader to [3] and [4].

We may now introduce our proposed modeling:

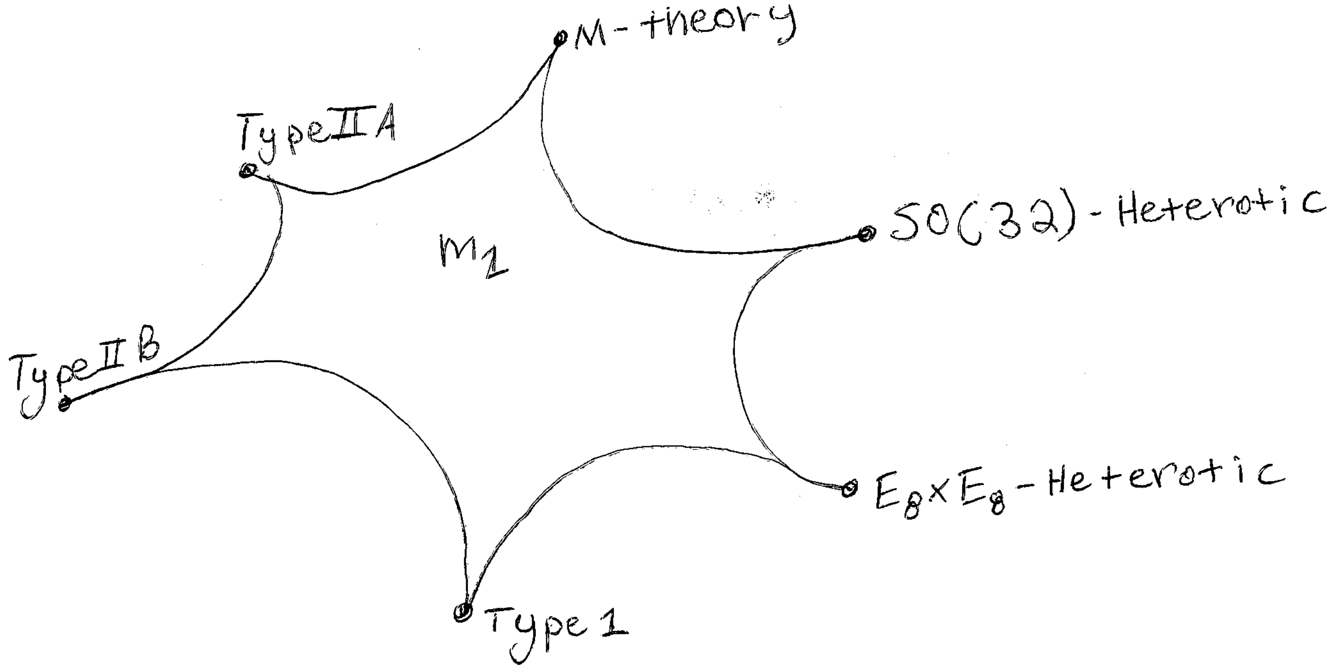
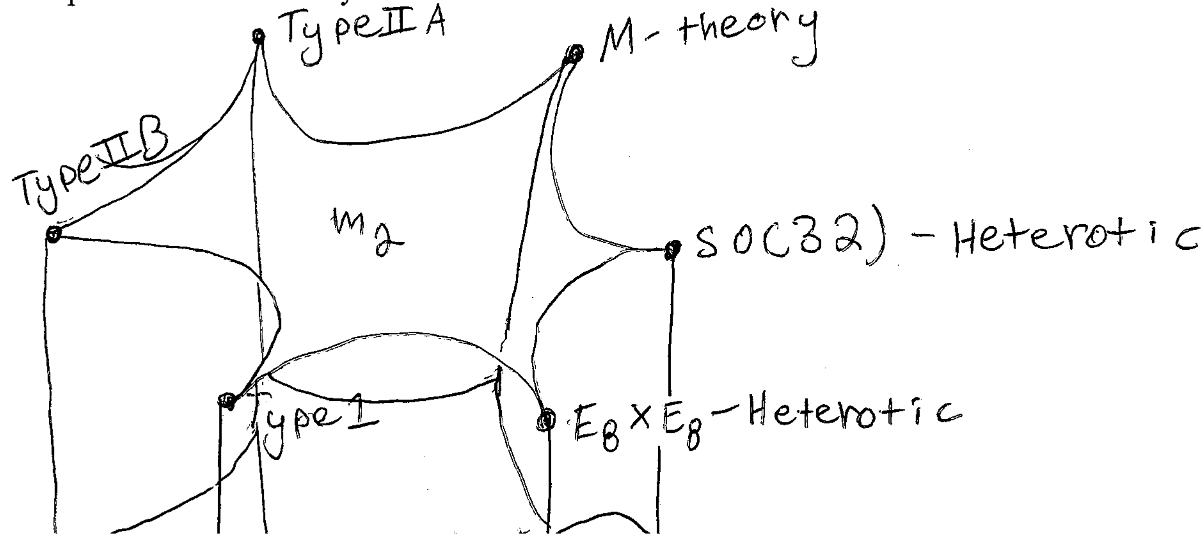


Fig. 1.1. All string theories/M-theory as limits of one theory.

Fig 1.1. effectively illustrates of what we are currently aware: there is a single theory, and all known string theories arise as limits of the parameter space, as does M-theory with 11 noncompact spacetime dimensions. For instance, if we define M-theory with a compactified longitudinal coordinate x^{11}, M-theory is thus by definition type IIA string theory. For another example, if one starts with type I theory on T^2, then by varying the two radii, the string coupling, and the Wilson line in one of the compact directions, one can reach the noncompact weakly coupled limit of any of the other string theories, or the noncompact limit of M-theory.



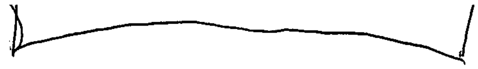


Fig.1.1.(membrane) = m_1

Fig.1.2.(membrane) = m_2

Fig 1.2. Our proposed modeling. Denoting the membrane of Fig 1.1. as m_1. and the membrane within this figure as m_2, we assert the following, that of the limits of our membranes m, we may further parameterize each string theory to a mathematical representation as a nonsingular projective algebraic variety embedded within the nondimensional N-fold. It is thus the purpose of the immediately following section to introduce the concepts of density/staticity matrices evolved from a pure state, and how we may define their corresponding density modes. The associated ease with which we may represent a) our model and b) the general results are indicative of, if correct, the presumable superiority of our representations.

2) Density, staticity matrices and density modes

We begin by following the pattern of the bosonic string. L_0 and $\tilde{L}_0$ are the center-of-mass modes of the world-sheet energy-momentum tensor, denoted $T_B, \tilde{T}_B$. We find the only nontrivial condition is from L_0, giving

$$m^2 = -k^2 = -\frac{1}{2\alpha'}. \tag{2.1}$$

This state is a tachyon. It has $\exp(\pi i F0) = -1$, where F is given by

$$\begin{aligned} \exp(\pi i F)|0\rangle_{NS} &= -|0\rangle_{NS}, \\ \exp(\pi i F)|s\rangle_R &= |s'\rangle_R \Gamma_{s's}. \end{aligned} \tag{2.2}$$

The first excited state is

$$|e;k\rangle_{NS} = e \cdot \psi_{-1/2}|0;k\rangle_{NS}. \tag{2.3}$$

The nontrivial physical state conditions are

$$\begin{aligned} 0 &= L_0|e;k\rangle_{NS} = \alpha' k^2 |e;k\rangle_{NS}, \\ 0 &= G^m_{1/2}|e;k\rangle_{NS} = (2\alpha')^{1/2} k \cdot e|0;k\rangle_{NS}, \end{aligned} \tag{2.4}$$

while

$$G^m_{-1/2}|0;k\rangle_{NS} = (2\alpha')^{1/2} k \cdot e|0;k\rangle_{NS} \tag{2.5}$$

is null. Thus

$$k^2 = 0, \quad e \cdot k = 0, \quad e^\mu \cong e^\mu + \lambda k^\mu. \tag{2.6}$$

This state is massless, the half-unit of excitation canceling the zero-point, energy, and has $\exp(\pi i F) = +1$. We assume familiarity with the characterization of a pure state, and we let this state in turn perform such a characterization, by the following analysis: In the limits of the closed string spectrum, the closed string is two copies of the open string, with the momentum rescaled $k \rightarrow \frac{1}{2}k$ in the generators. With $v, \tilde{v}$ taking the values 0 and $\frac{1}{2}$, the mass-shell condition can be summarized as

$$\frac{\alpha'}{4}m^2 = N - v = \tilde{N} - \tilde{v}. \tag{2.7}$$

Thus, we obtain the tachyonic and massless closed string spectrum by combining one left-moving and one right-moving state, subject to the equality (2.7). Characterizing this state by $|\psi_A\rangle = \frac{1}{2}|\uparrow_x\rangle$, provided $|\psi_A\rangle$ is a pure state, we thus obtain a density matrix $\hat{\rho}$, such that

$$\hat{p} = \sum w_i |\psi_i\rangle\langle\psi_i| = \sum_{i,j,k} w_i (V_i)_j (V^\uparrow{}_i)_k |j\rangle\langle k| = \sum_{j,k} \rho_{jk} |j\rangle\langle k|. \tag{2.8}$$

From (2.8), we may define a corresponding staticity matrice, which we define as the measurement of the statistical basis for correspondence between the string theories/M-theory (as parameters of our model), i.e. the staticity of the relations of our theories given singularity. We do this through an analysis of the superconformal generators of sectors (not necessarily Neveu-Schwarz and Ramond, although those are the most commonly seen) relative to the superconformal generators of the other theories. It is possible to define a staticity matrice irregardless of the presence of generators. Thus, we find for our example, for the generators L_m and G_r, such that

$$\begin{aligned} L_m &= \frac{1}{2}\sum_{n\in Z} {}^\circ_\circ \alpha^\mu{}_{m-n}\alpha_{\mu n} {}^\circ_\circ + \frac{1}{4}\sum_{r\in Z+v} (2r-m) {}^\circ_\circ \psi^\mu_{m-r}\psi_{\mu r} {}^\circ_\circ + a^m \delta_{m,0}, \\ G_r &= \sum_{n\in Z} \alpha^\mu_n \psi_{\mu r-n}. \end{aligned} \tag{2.9}$$

${}^\circ_\circ \; {}^\circ_\circ$ denotes creation-annihilation normal ordering. We may define a staticity matrice $\langle S\rangle$

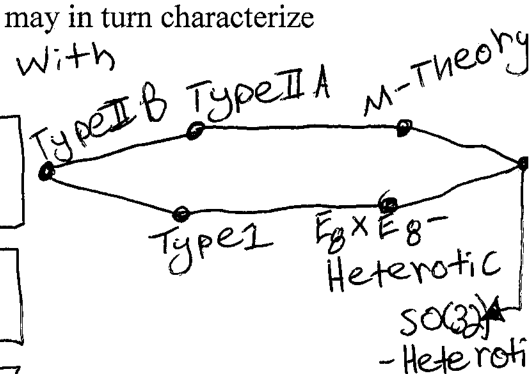
$$\langle S\rangle = \sum w_i \left\langle \psi_i \middle| \hat{A} \middle| \psi_i \right\rangle, \tag{2.10}$$

where w_i represents the generators of the theory (as defined in the R, NS sectors respectively), and ψ_i represents its' (physical) states. We may obtain the pure state $|\psi_A\rangle$ from this matrix by performing the operation $\left\langle \hat{A} \right\rangle - \left\langle \psi_i \middle| \hat{A} \middle| \psi_i \right\rangle$, leaving the generators and $\left|\hat{A}\right|$, so that we may reach the pure state from there.

We define the concept of density modes as follows: Having defined the staticity matrice, we need only classify the matrice, and then we may define the density mode. We classify a staticity matrice given the theory in which the sectors of its generators are defined, such that we may use the following chart:

$$
\begin{aligned}
&F = \text{Type IIB} = H^{p,p}(Q,s,t)_{\text{IIB}}\\
&A = \text{Type IIA} = H^{p,p}(Q,s,t)_{IIA}\\
&C = \text{SO(32)-Heterotic} = H^{p,p}(Q,s,t(\text{SO(32)}))_{32(\text{SO})}\\
(2.11)\qquad &E = \text{Type I} = H^{p,p}(Z,s,t)\\
&D = \text{E}_8 \times E_8 \text{ heterotic} = H^{p,p}(Q,s,t)\delta_{n_1}\\
&B = \text{M-theory} = H^{p,p}(Q,s,t)\delta_{n_X}.
\end{aligned}
$$

with the theory equating to its corresponding definition as a nonsingular projective algebraic variety embedded in the nondimensional N-fold of our modeling. Thus, we may define our density mode η_n, where n is any [F,A,C,E,D,B]. We may in turn characterize [F,A,C,E,D,B]:



F=

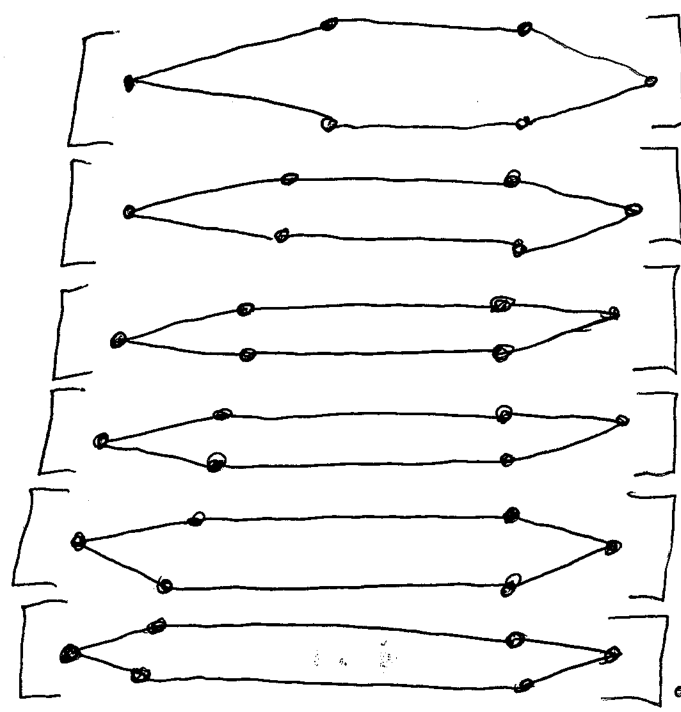
A=

C=

E=

D=

B=



We obtain the area of the membrane from the density mode as follows:

$$
(2.12)\qquad a = \sum_{kT=0}^{\infty} \eta_F, \eta_A, \eta_C, \ldots, \eta_n kT \frac{\hbar_0}{T_0 : T_p{}^k}
$$

$$
= \sum_{kT=0}^{\infty} \eta_n \frac{\hbar_0}{T_0} \frac{2\pi}{R\eta_n} = \frac{2\pi}{R\eta_n} = \frac{2\pi}{\eta_n}.
$$

Thus, we have demonstrated how, from our representation of a density mode, we may nullify dimensionality. We conclude that we may calculate the density mode of any [F,A,C,E,D,B] as follows: Find a pure state in an analysis of the theory, find its' correspondence amongst the string theories by identifying its generators, define its' staticity matrice, classify it, reduce through simplification, and we have our density mode.

3) Our constant EGM, λ

From the consideration of our results in section 2), we find an anomaly, in that we may characterize phenomena associated with each [F,A,C,E,D,B} of our model as physically observable, however for [F,A,C,E,D,B] defined at different values (that are apparently corresponding), we find them lacking such necessary characterizations. As such, at this point we are required to theoretically introduce the concept of the holographic constant- i.e. EGM, or λ. By the introduction and definition of this constant we see that we may effectively characterize [F,A,C,E,D,B} in the desired way. We define λ by the Clifford algebra $\{\Gamma^{\mu},\Gamma^{\nu}\}$, such that

(2.13) $$\{\Gamma^{\mu},\Gamma^{\nu}\}=G_n=\lambda .$$

We present the following axioms concerning λ. We define a local GM action tensor as follows, representing the system of staticity matrices regularized by λ on m,

(2.14) $$T\delta_{ni}{}^{4}a_{ij}\beta_{ij}{}^{\lambda}=T\delta_{ni}{}^{4}=a_{ij}\beta_{ij}{}^{\lambda} .$$

This lends itself to a calculation directly resultant of the aforementioned relation $\lambda\cong-\Lambda$,

(2.15) $$\overset{f}{C}_{ij}=\frac{1}{\exp(2\pi)!}(2H^{2}{}_{vivj}-2H_{i}H_{j}-g_{ij}H^{2}) .$$

This result will be discussed (and formally presented) in a later work, however it is interesting to note that a thorough analysis yields exact correspondence to the area of significant quantities of "dark matter" throughout the universe. We continue with the presentation of our axioms, assuming G_n is the λ action on m by $\Phi_{nij}\to G$, where $\Phi_{nij}=T\delta_{ni}{}^{4}$, and Φ_{nij} may thus denote the local GM action tensor. We have:

(1) $\Im_0\equiv x/c$, $\Im_n\in\ell'(IR^{4n})$.

(2) Scale invariance for $\{G\}_{n=0}^{\infty}$ on η_n,

$$\Im_n(G)=\Im_n(f_{\alpha,R})\text{ for all }\overset{f}{G}_j ,$$

(3) Positivity,

$$\sum_{\alpha,\beta}\Im_{\alpha_n+\beta_m}(\Theta G_n{}^{*}\times G_m{}^{f})\geq 0,\text{ for all }\underset{\square}{G}\in\ell,$$

(4) Symmetry,

$$\Im_n(G)=\Im_n(G^{\pi}),\text{ for all permutations }\pi\in\lambda^{\beta}{}_n\text{, all}$$

$G\in\ell(R^{4_n})$,

(5) Cluster property,

$$\lim_{\lambda\to\infty}\sum_{\{\alpha+,\beta\in \atop \alpha,\beta}\{G^{2*}{}_n\times g_{\beta}(\lambda_{\underset{\square}{\alpha},1})-\Im_{\alpha_n}(\Theta G_n^{*})\Im_{\beta}^{*}(g_{\beta})\}=0,\text{ for all}$$

$\underset{\square}{G}$, $g\in\ell_+$, $\underset{\square}{g}=(0,\underset{\square}{a})$, $\underset{\square}{a}\in B^3$

(6) Temperedness,

(7) Relativistic invariance,
(8) Positivity,
(9) Transformation invariance,
(10) Local commutativity,
(11) Cluster property,
(12) Spectral condition,
(13) Hermiticity,
(14) Anisotropism.

We will now introduce several theorems concerning these axioms for λ.

Theorem 1): There exists for a scale invariance $\overset{f}{C}_{ij}$, a corresponding gauge invariance

$$\overset{f}{C}_{ij} \to G_{\alpha}^{\beta} = \tag{3.1}$$
$$\overset{f\in}{C}_{ij} \to G_{\alpha}^{\in\beta}.$$

Theorem 2): For the scale invariance of 1), there exists conditions (1)-(14).

Theorem 3): Conditions (1) and (2) yield (3)-(14).

Theorem 4): For conditions (3), (5), (8), (9), (10), (11), and (12), there exist gauge functions which yield each other commutatively, given the gauge invariance transformation of 1).

Theorem 5): For a given sequence of the gauge functions of theorem 4) satisfying conditions (1)-(5) there exists a unique sequence of eigenfunctions with the properties of (6)-(8) and (10)-(13), closely resembling Wightman distributions.

Theorem 6): For a given sequence of eigenfunctions resembling Wightman distributions in the above way satisfying (1)-(8), (10), (12), and (13), there corresponds a unique sequence of gauge functions with the properties (1)-(5).

Theorem 7): To a given sequence of EGM, λ distributions there exists a corresponding sequence of distributions over a scale invariance, from which we may obtain the original sequence (and may not necessarily be interpreted as a sequence of distributions over a scale invariance).

Theorem 8): For a given sequence of EGM, λ distributions over a scale invariance, there is a corresponding sequence of EGM, λ distributions over a gauge invariance.

Note that one could compactify these results to three dimensions and obtain a satisfying quantum Yang-Mills theory. Consequential of the supersymmetry of our modeling, and by the work of [3], we also note that our characterizations allow us to contain the entire Fock space of massless well separated particles of the supergravity theory. Having stated these theorems, we now move on to a necessary definition of the cohomology from which we may obtain the nonsingular projective algebraic definitions of [F,A,C,E,D,B], then continuing in the subsequent section to the introduction and definition of a holographic space, i.e. the space characterized mathematically by density modes, that may be interpreted equivalently as nonsingular projective algebraic varieties in a holomorphic-commutative geometry embedded in a holomorphic-commutative spacetime, assuming we nullify the holomorphic-commutative spacetime. Thus, we continue to an obtainment of the desired cohomology:

3.1) SE- cohomology (static-expansionary cohomology)

We define SE- Cohomology as the characterization of SE-transformations by the classes of collinear integral combinations for a Hodge group G, related to [F,A,C,E,D,B] in the expected way. Thus, we may define an SE-transformation by, given a metric $\delta^{m\ddot{\alpha}}_{n\beta_{ijkl}}\Omega^{uA}_{A\beta}/\frac{\pi}{2}$ for a system of static-expansionary (SE) transformations,

$$\eta_n^{\delta^{\alpha n}{}_{ni}} \rightarrow \eta_n^{\delta_{\alpha m}A_{ni}}, \tag{3.1.1}$$

where α and β are the set covariants of two Galileon fields,

$$\alpha_{Perturb} = \{ \begin{array}{c} \Delta\Phi = -4\pi G_p + \xi\Delta\varphi \\ \Phi + \Psi = -\alpha\varphi, \end{array},$$

$$\beta_{Perturb} = \{ \begin{array}{c} \Delta\varphi + \lambda^2(\varphi_{ij}\varphi^{ij} - (\Delta\varphi)^2 = -4\pi G\varphi_p, \\ C\{\frac{\pi}{2}\lambda^{ij}\Omega^{ij}_{\beta i}. \end{array} \tag{3.1.2}$$

ξ is the nonlinear decomposition into nonlocality, Φ remains as in the local GM action tensor, the Laplace operator Δ represents differentiation with respect to point coordinates in physical fields, and p is the density mode.

4) The holomorphic-commutative geometry embedded in a holomorphic-commutative spacetime

We define the holomorphic-commutative geometry embedded in a holomorphic commutative spacetime, and the desired space associated therewith, similarly to the definition of a noncommutative geometry embedded in a noncommutative spacetime, however the geometry is left-moving or right moving, so that it is not necessarily commutative (i.e. it may be either commutative, noncommutative, or anticommutative), and the spacetime is nullified and thus vanishes.

5) Conclusion

We have satisfied our attempts by the methods summarized within the abstract and the introduction of this paper, as such we will conclude this work without further extension.

Acknowledgments: Dr. Clinton Ackerman

References: [1] String Theory, Volume II, Superstring theory and beyond, Joseph Polchinski, Cambridge University Press, 1998

[2] arXiv:hep-th/9901156v1

[3] arXiv:hep-th/9610043v3

[4] **arXiv:hep-th/9603081v2**